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# DEFENSE SYSTEMS <sup>①</sup> MANAGEMENT COLLEGE



## PROGRAM MANAGEMENT COURSE INDIVIDUAL STUDY PROGRAM

INTEGRATION OF NEW WEAPON SYSTEMS  
INTO EXISTING SHIP CLASSES:  
AN ORDERLY APPROACH

STUDY PROJECT REPORT  
PMC 77-1

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INTEGRATION OF NEW WEAPON SYSTEMS INTO EXISTING SHIP CLASSES:

AN ORDERLY APPROACH

Individual Study Program

Study Project Report

Prepared as a Formal Report

Defense Systems Management College

Program Management Course

Class 77-1

by

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## DEFENSE SYSTEMS MANAGEMENT COLLEGE

### STUDY TITLE:

THE IMPACT OF NEW BOARD SYSTEMS INTO EXISTING SHIP CLASSES;  
IN QUINCY, ILLINOIS

### STUDY PROJECT GOALS:

To develop a comprehensive plan of accomplishing key events to assist the responsible system manager in the integration of his system into existing ship classes.

### STUDY REPORT ABSTRACT:

This report was prepared as an attempt to gain an understanding of the overall ship modification processes by which systems being developed and produced are integrated into existing classes of ships. A narrative description of the process is presented listing each step of the development of a modification in chronological order.

It was concluded that the established procedures are well constructed and are being used for effective use. Identification of proposed alterations, submission of either a Standard Military Improvement Plan or a Technical Improvement Plan, evaluation of these proposals by a board of ship class members, entry of proposed alterations into the Standard Military Improvement Plan or Technical Improvement Plan, development of the alteration and funding the alteration for accomplishment under the Standard Military Improvement Plan, and all be parts of an integrated effort in order to improve the interaction between system development and acquisition and the operation of new systems on fleet platforms. The total process can be shortened but can be shortened by achieving as much of the process as early as the process.

The report includes a flowchart showing the sequential steps in a modified and unmodified process.

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May 1977

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## EXECUTIVE SUMMARY

This report summarized existing navy procedures followed from the proposal of a new system to be added to the fleet to its installation in existing ships. (Integration into the design of new ships is not discussed.) It draws upon documents and interviews to present an overview of the total process by which new weapon systems are made available for operational use, and it suggests means of minimizing the amount of time between the proposal of a new system and its installation in the fleet. The information is useful for the purpose of providing an understanding of the sequential process to the weapon system acquisition manager.



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## SECTION I

### INTRODUCTION

The development of new weapon systems constantly provides the surface Navy with new or improved capabilities. Each new system generates a list of candidate classes of ships in which it is to be installed, and the weapon system acquisition manager is faced with the problem of dealing with as many different interfaces as there are candidate classes of ships. For example, the Harpoon weapon system is planned for installation in sixteen classes of U.S. Navy surface ships which range in size from patrol hydrofoils to nuclear-powered strike cruisers, vary in age from drawing board to in excess of thirty years, and utilize six different launchers. The passage of time since the building of the oldest of these ships has brought about changing requirements in such areas as shock and vibration capability. The system/ship interfaces include all combinations of digital, analog, synchro, and discrete signals. Each different interface forces program managers to develop a suitable installation method and involves deltas in documentation, spares, and training. The Harpoon system is not an isolated instance of this problem. Other systems such as the Close In Weapon System (CIWS), the Tomahawk system, and additional developmental and future systems can expect a similar variety of host platforms.

The Naval Sea Systems Command (NAVSEA) is the organization tasked with the development and implementation of administrative procedures to

effect an orderly progression from the development of a weapon system to its installation in the fleet. The purpose of this report is to gather the information on these procedures from the various documentary sources where it is contained (See bibliography of documents.) and to integrate it into a description of the process whereby a new system is installed in existing ships. (The unique problems associated with integrating new weapon systems into new ship classes, in which the weapon system acquisition manager must work closely with the Ship Acquisition Project Manager [SHAPM], will not be discussed.) It will be assumed that the weapon system to be integrated into candidate ships is proceeding with reasonable smoothness through the milestones of major systems acquisitions as defined in Department of Defense Directive 5000.1 of 18 January 1977.

## SECTION II

### NARRATIVE DESCRIPTION OF THE INTEGRATION PROCEDURE

The first step in scheduling the system for installation in any given class/classes of ships is the submission by the sponsor of the proposed alteration of a Proposed Military Improvement (PMI) if a new capability is involved or a Proposed Technical Improvement (PTI) if an improvement to an existing capability is involved. A PMI must be forwarded to the Chief of Naval Operations (CNO) for approval. The Ship Logistic Division (SLD) of the Naval Sea Systems Command (NAVSEA) reviews and approves PTIs. The PMI/PTI format includes data such as physical description of equipment, status of development, procurement cost, development

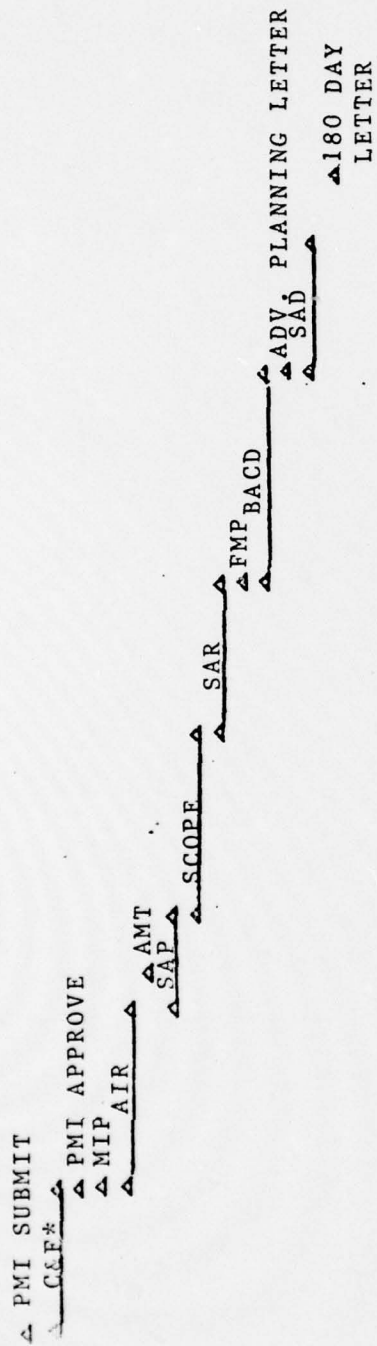
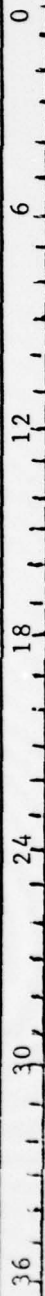


costs, and schedule of anticipated equipment availability. At this early stage in the process, the first step toward ensuring logistic support of the alteration is taken by the submission, with the PMI or PTI, of a Bill of Material (BOM) for the primary equipment involved in the alteration. Since the PMI is a slightly more complex case than the PTI, we will assume that the nominal alteration under discussion is the addition of a new capability and, therefore, the subject of a PMI. Figure 1A depicts the sequence of events in the development of an alteration.

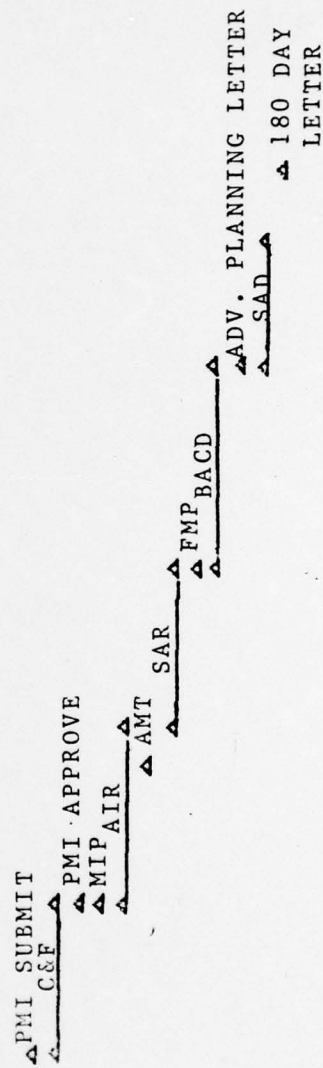
After initial review of the PMI, CNO forwards the proposal to NAVSEA, requesting accomplishment of a cost and feasibility study if the complexity of the proposed alteration warrants it. The cost and feasibility study investigates such areas as the weight and moment impact on the ship's stability, proposed equipment locations, physical and electromagnetic interferences, structural modifications, interfaces (to a block diagram level), support requirements (e.g. chilled water, ventilation, electrical power), security, and impacts on manning, berthing, and habitability. The study may also refine the BOM. Once the study is completed, it is returned to CNO for review, approval, and authorization for the inclusion of the PMI in the Military Improvement Plan (MIP), a listing of approved PMIs.

The approved PMI is returned to the NAVSEA SLD (Ship Logistic Division), where it is assigned an alteration number, a title, and a prefix indicating the source of funding for accomplishment of the alteration. These prefixes are K, indicating funding through NAVSEA; D, indicating funding through the Type Commander (e.g. Commander, Naval Surface Force, U.S. Pacific/

MONTHS PRIOR TO FIRST INSTALLATION



1A. NORMAL PROCESS



1B. STREAMLINED PROCESS

\* COST & FEASIBILITY STUDY

Atlantic Fleet); or F, indicating funding through forces afloat (repair ships, tenders, etc.). The BOM is entered into the Ship Alteration Management Information System (SAMIS), and the alteration is then considered to be officially entered in the Military Improvement Plan. The MIP is combined with the Technical Improvement Plan, made up of approved PTIs (Proposed Technical Improvements), and is called the Amalgamated Military Improvement Plan/Technical Improvement Plan (AMT). The alterations included in the AMT are prioritized for accomplishment during periodic fleet modernization conferences, attended by representatives of CNO, NAVSEA, and the Fleet Commanders.

There are two possible modification methods by which weapon systems may be added to existing operational ships. The installation of a new system is called a Ship Alteration (SHIPALT). Modification to installed ordnance equipment is called an Ordnance Alteration (ORDALT). A SHIPALT may have one or more ORDALTs associated with it as prerequisite or concurrent installation requirements. These ALTs may be considered as packages containing all the details of integrating the system into the ship. Since ORDALT development and accomplishment is normally a simpler, more straightforward procedure than the SHIPALT process, this discussion will restrict itself to the SHIPALT process.

In order to identify the details of integration of a system into a ship class, it is necessary to establish the "as-is" configuration of the class, representing the summation of all modifications which have been accomplished to the class since it entered the fleet. Analysis of the drawings and plans for the class establishes the baseline configuration.

Once the proposed improvement is included in the AMT (Amalgamated

Military Improvement Plan/Technical Improvement Plan), development of the details of the alteration is begun. The first step in this process is preparation of the Alteration Installation Requirements (AIR). The AIR correlates the ship configuration documentation, the cost and feasibility study, and the interface documentation of the system to be installed. The AIR increases the amount of alteration detail to include size, weight, standard or non-standard stock, and spare parts support including source, material availability, and technical documentation requirements. It further refined the BOM (Bill of Material). If the alteration is considered sufficiently defined by the NAVSEA SLD (Ship Logistic Division), the subsequent steps of preparation of the Ship Alteration Proposal (SAP) and the alteration scope in the SHIPALT development process may be omitted. Conditions under which the SAP and the scope may not be required are:

- a) The estimated direct installation man-day requirements are less than five hundred.
- b) Installation cost estimates are considered accurate to within twenty percent.
- c) Any special program material requirements have been identified.
- d) Major categories of the scope outline are either not applicable or have been completed.

The alteration material requirements are inserted into SAMIS (the Ship Alteration Management Information System).

If review of the Alteration Installation Requirements indicates that shortcuts in the SHIPALT development process are not warranted, the Ship Alteration Proposal is prepared by the NAVSEA Ship Logistic Division or its designated representative. The completed SAP is attached to a letter tasking



a design agent to develop the scope of the alteration. The SAP includes such information from SAMIS as nomenclature, identification by stock number of manufacturer's part number, quantity required per ship, operating and technical characteristics, space and weight requirements, drawing numbers, and specifications. The SAP once again updates the BOM, using all the information available from the original PMI, the cost and feasibility study, and the AIR.

The next step in the process is the preparation of the alteration scope by a design agent tasked by the NAVSEA Ship Logistic Division. This design agent is normally the planning shipyard responsible for development of alterations to the ship class in question. The scope includes the following:

- a) A general description of the alteration.
- b) The rationale for accomplishment of the alteration.
- c) Description of installation requirements for new equipment; ripout of existing equipment; certifications required; and shock, vibration, and noise requirements.
- d) Watertight integrity.
- e) Self-generated noise characteristics.
- f) Interrelated alterations.
- g) Quality control.
- h) Documentation affected.
- i) Preventive Maintenance (PMS) requirements.
- j) Tests to be conducted.
- k) Training requirements.
- l) Material requirements including spares.



- m) Production requirements.
- n) Weight and moment changes.
- o) Changes to demands on services such as air, water, and power.
- p) Costs of installation.
- q) Safety Considerations.

The scope also includes a consolidated BOM listing all materials with ordering data as developed in the previous BOMs and adding special material identification codes, units of issue for items to be ordered, service use, unit cost with base year, categories of material such as long-lead-time or centrally procured, end-use drawing and piece numbers, cabling and piping, and components and equipment to be removed or relocated during accomplishment of the alteration.

The consolidated BOM is reviewed by the NAVSEA Ship Logistic Division or its designated agent for completeness, use of National Stock Numbers, duplications, and material categorization. Upon completion of review, the scope is approved by the NAVSEA SLD and the consolidated BOM is inserted into SAMIS. The Ship Alteration Record (SAR) is next prepared from the information contained in SAMIS, augmented by data from any or all of the previous steps in the alteration development. The SAR contains the same consolidated BOM as the scope.

After completion of the SAR, the alteration is ready to be included in the Fleet Modernization Program (FMP), which contains the priority listing of all outstanding SHIPALTs from the AMT (Amalgamated Military Improvement Plan/Technical Improvement Plan). The FMP is a six-year document which indicates the scheduled overhauls of each ship by hull number and location, the alterations planned for accomplishment during a given

overhaul, the estimated procurement cost for the hardware associated with each alteration, the estimated manpower effort and cost to install each alteration, and a general statement on the status of completeness of the BOM. The FMP considers operational requirements, schedule, and the information available from SAMIS in deciding to program (i.e., schedule and fund) an alteration for accomplishment in a given hull during a particular time frame. In the case of a system under procurement, the procurement lead time is taken into account when programming an alteration for accomplishment under the FMP.

Once the alteration has been programmed in the FMP for accomplishment, a portion of Operation and Maintenance, Navy (O&MN) funding called Design Services Allocation (DSA) is authorized to prepare the Basic Alteration Class Drawings (BACDs) reflecting the alteration and to update selected ship's records upon completion of the alteration. (An interesting anomaly is that DSA funds do not provide for updating documentation affected by accomplishment of ORDALTs.) The NAVSEA Ship Logistic Division then tasks a design agent, who is provided with the complete alteration scope documentation, to develop the BACDs. Once again, the BOM is updated and refined as necessary. The NAVSEA SLD reviews and approves the completed BACDs and enters the BACD BOM into SAMIS.

Unique configurations within a class of ships are occasionally encountered. When this situation is found to exist, Supplementary Alteration Drawings (SADs) are prepared. These SADs, in general, apply to only a few ships. The unique material requirements identified in the SADs are usually procured by the designated installing activity.

Once the alteration is programmed in the FMP for accomplishment and

the BACDs are complete, procurement of material and installation planning may begin. An advance planning letter is sent by NAVSEA to the installing activity one year prior to the planned installation so that requirements and detailed scheduling may be accomplished. A follow-on letter is sent six months prior to the installation to confirm the alterations to be accomplished. This follow-on letter is called the one hundred-eighty day letter. At this point the alteration process, except for the not insignificant details of the actual installation, is complete. It has taken more than three years from submission of the original PMI to installation of the system on the first ship of a class. See Figure 1A.

### SECTION III

#### POSSIBILITIES FOR STREAMLINING THE PROCEDURE

The procedures outlined in the preceding section, followed sequentially, ensure development of a well defined, documented, logistically supported alteration. Some programs, however, cannot afford the luxury of devoting more than three years to the preparation for the first installation. Accordingly, it is worthwhile to examine possibilities for shortening the SHIPALT development process.

As was mentioned above during the description of the Alteration Installation Requirements (AIR), it is possible to omit the Ship Alteration Proposal (SAP) and the development of an alteration scope if the AIR is detailed enough to fulfill the stated set of requirements. (See p. 6 above.) Preparing a SAP and scope takes up to eight months. Deleting them would save most of that time, even though some additional time would



probably have to be spent in the production of a more refined AIR. See Figure 1B for a comparison of the streamlined process with the original.

Contingencies for emergent requirements in the FMP also provide possibilities for streamlining the alteration development process. Requirements which arise during the execution year of the FMP can be accommodated by either reprogramming funds or compensating at the expense of other programs within the FMP. In this case, it is necessary that a thorough study be conducted to ensure that all material can be made available, that the alteration is feasible, and that all interface problems have been resolved. The time saved by this contingency could allow later completion of the SAR (Ship Alteration Record), but might entail risk in Basic Alteration Class Drawing development. The FMP also allows a high priority PMI to be entered directly into the MIP (Military Improvement Plan), the AMT (Amalgamated Military Improvement Plan/Technical Improvement Plan), and the FMP, which could reduce some of the administrative time involved in the process. Spending extra effort on development of a detailed AIR appears to be the best way to minimize SHIPALT development time, however.

## SECTION V

### CONCLUDING REMARKS

In order to optimize the interface between weapon system development and acquisition on the one hand and installation in fleet platforms on the other, identification of a proposed alteration, evaluation of it through cost and feasibility studies, approval of the alteration, development of

specific alteration plans, and funding the accomplishment of the alteration in the Fleet Modernization Program must all be parts of an integrated effort. The prescribed NAVSEA process for integrating new weapon systems into existing ships is well constructed and sufficiently detailed for effective implementation. Problems which arise in the implementation of the process can generally be traced to a lack of compliance with some step in the orderly development sequence. The length of time required to carry out the process, however, is a disadvantage. When no other aspects of system development will be jeopardized by acceleration of the first installation, the shortcuts provided for in the prescribed procedures should be utilized. The most promising of these for wide application is the development of the Alteration Installation Requirement (AIR) to as great a level of detail as possible.



## APPENDIX

### LIST OF ACRONYMS

AIR	Alteration Installation Requirement
AMT	Amalgamated Military Improvement Plan/Technical Improvement Plan
BACD	Basic Alteration Class Drawing
BOM	Bill of Material
CIWS	Close In Weapon System
CNO	Chief of Naval Operations
DSA	Design Services Allocation
FMP	Fleet Modernization Program
MIP	Military Improvement Plan
NAVSEA	Naval Sea Systems Command
ORDALT	Ordnance Alteration
PMI	Proposed Military Improvement
PMS	Preventive Maintenance Subsystem)
PTI	Proposed Technical Improvement
O&MN	Operations and Maintenance, Navy
SAD	Supplementary Alteration Drawing
SAMIS	Ship Alteration Management Information System
SAP	Ship Alteration Proposal
SAR	Ship Alteration Record
SHAPM	Ship Acquisition Project Manager
SHIPALT	Ship Alteration
SLD	Ship Logistic Division

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